CHAPTER 3

REVIEW OF LITERATURE

The idea of "bubbles" in asset prices has been discussed almost since organized markets began. Therefore, we will review the related working papers by comparing the studied objectives, data, research methods and results of each paper in this section.

A number of studies such as **Robert J. Shiller (1981), Oliver J. Blanchard and Mark Watson (1982), Kenneth D. West (1988)** have argued that dividend and stock price data are not consistent with the "market fundamentals" hypothesis, in which prices are given by the present discounted values of the expected dividends. These results have often been constructed as evidence for the existence of bubbles or fads. Related arguments also have been made with respect to gold, bonds and foreign exchange. According to **James Hamilton and Charles Whiteman (1985)**, a major problem with such arguments is that apparent evidence for bubbles can be reinterpreted in terms of market fundamentals that are unobserved by the researcher.

There are two categories of bubble tests. The first category of bubble test compares the actual prices to fundamentals, which are believed to determined price. The second category of bubble test examines returns for empirical attributes of bubbles such as autocorrelation, skewness and kurtosis, which result from the two characteristics of bubbles: extended runs of positive abnormal returns and crashes.

Shiller (1981) and West (1987) follow the first category of bubble test and they can find evidence of bubbles after comparing stock prices with dividends. These tests based on either variance bounds (e.g. **Shiller (1981) and LeRoy** and **Peter (1981)**) or on regressions (e.g., **West (1987)**), assume linearity relating all the observations in a series to the value of prior observations using one set of parameters. However, rational speculative bubbles suggest nonlinear patterns in returns.

Nevertheless, the **Shiller (1981)** and **West (1987)** 's methodology and conclusions are questioned by **Flood and Garber (1980), Flavin (1983), Kleidon (1986), Marsh and Merton (1986), Flood, Hodrick, and Kaplan (1987) and West (1988)**, among others. In general, the critique point out that the tests for bubbles using stock prices and fundamentals are actually joint tests of the no-bubbles hypothesis, the assumption made about the model relating fundamentals to prices, and the assumptions made about the time series properties of the fundamentals themselves.

On the contrary, **Blanchard and Watson (1982)** follow the second category of bubble tests by using their “runs test” (autocorrelation) in the gold market, which fail to reject the no-bubble hypothesis but do find support for the hypothesis in their “tail-test” (kurtosis). **Evans (1986)** finds find support in foreign exchange markets using “median test” (skewness). However, these attributes are not unique to bubbles and are often associated with fundamentals.

According to **Blanchard and Watson (1982)** [5], they investigate the nature and the presence of bubbles in financial markets by using runs tests and tail tests. Both refer to the distribution of innovations in prices or equivalently the distribution of excess returns. A run is a sequence of realizations of a random variable with the same sign.

The bubble component of the price innovation appears likely to have both runs and a distribution with fat tails. If bubbles grow for a while and then crash, the innovations in the bubble will tend to be of the same sign while the bubble continues, then reverse sign when a crash occurs. The runs for the bubble innovation will then tend to be longer than for a purely random sequence, making the total number of runs over the sample smaller. Crashes will produce large outlier so that the distribution of innovations will have fat tails (i.e. the distribution will be leptokurtic).

They use weekly gold prices (Englehart) from the period January 1975 to June 1981 as the data. The results of the runs tests reveal no evidence indicating the presence of bubbles.

For the tails tests, the bubbles will at times explodes or crashes. While the bubble is growing it will generate small positive excess returns, which will be followed at the time of the crash by a large negative excess return. The distribution of innovations for this type of bubble will therefore be leptokurtic. This suggests that a large coefficient of kurtosis for price innovations might indicate the presence of bubbles. However, the

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[5] Ibid.

results are intriguing because the very high coefficient of kurtosis can suggest either very leptokurtic market fundamentals or the existence of bubbles.

Therefore, **Blandchard and Watson (1982)** conclude that the speculative bubbles are not ruled out by rational behavior in financial markets and are likely to have real effects on the economy. They also mention that testing for speculative bubbles is not easy and other tests for bubbles should be suggested when only price data is available.

On the contrary, **Robert P. Flood and Robert J. Hodrick (1986)** [6] examine whether some of the variance bounds tests reported to date provide evidence for the hypothesis that asset prices contain speculative bubbles. They demonstrate the sense in which the existence of bubbles can in theory lead to excess volatility of asset prices relative to the volatility of market fundamentals, but they explain why certain variants of variance bounds tests preclude bubbles as a reason that asset price might violate such bounds. Moreover, they also try to explain, in terms of a simple model economy, how anticipated changes in market fundamentals may produce asset price paths that would appear, to an empirical researcher who is unaware of the potential change, to be characterized by bubbles, even though the economy is bubble free. The example economy is described by a potential change in government policies that they label a process switch.

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[6] Robert P. Flood and Robert J. Hodrick, "Asset Price Volatility, Bubbles, and Process Switching," The Journal of Finance XLI, No. 4 (September 1986) : 831-842.

From the results, they conclude that the failure of some variance bounds tests should not be taken as evidence of rational speculative bubbles, because design of the tests precludes bubbles as a reason for failure of the tests. Additionally, they also argue that bubbles tests are hard to design since the path of a bubble in the data would look like some forms of incorrect modeling of agent's expectations. However, they provide a cautionary note to those who would test for bubbles that bubble tests require the investigator correctly identify the processes used by agents in forming their expectations. In this sense bubble tests are open to the same criticism as is any test conditioned on correct modeling of agents' beliefs-the researcher must in fact conduct a test of a joint hypothesis that correctly models expectations. As can be seen from the variance bounds test described by **LeRoy and Porter (1981)** and the methodology for testing for bubbles proposed by **West (1984)** are also sensitive to the issue of modeling agents' expectations and the potential failure of the data to satisfy the ergodicity assumption.

Additionally **Woo, Wing Thye (1987)** [7] examine by focus on the important of speculative bubbles in the bilateral exchange rate of the US dollar with the currencies of Germany, France and Japan. The assumption of rational expectations makes it possible to differentiate between 2 types of deviations from the value dictated by the fundamentals: speculative bubbles and error terms. A rational speculative bubble specifies that its trend term is a precise function of the structural parameters of the asset demand equation. Central to the analysis is an estimation of a version of the portfolio-balance model of

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[7] Woo and Wing Thye, "Some Evidence of Speculative Bubbles in the Foreign Exchange Markets," <u>Journal of Money Credit and Banking</u> (November 1987) : 499-514.

exchange rate determination. The bubble-augmented portfolio model is subjected to the usual statistical tests and an out-of-sample dynamic forecasting exercise to match the model's forecasts with those from its unconstrained vector autoregression equivalent. Reasonable evidence is provided in support of the model. However, a cautious interpretation of the results is advised.

According to **Hardouvelis, Gikas A. (1988)** [8], evidence is found that it is consistent with the hypothesis of rational bubbles in the national stock markets of Japan and the US before the October 1987 crash. In the UK, however, the evidence is somewhat weaker. Evidence for the presence of rational bubbles is a positive and increasing bubble premium, which market participants require in order to invest during a bubble period. During the lifetime of a rational speculative bubble, market participants expect to receive positive abnormal returns as compensation for the probability of a bubble crash and a large onetime loss. The size of bubbles premium grows over time as the bubble unfolds because the degree of market overvaluation increases. As the magnitude of the potential loss during crash increases, investors require progressively larger compensation. The data show a positive and rising bubble premium for one and one-half years before the crash in the nationals stock markets of Japan and the US and for a half year before October 1987 in the national stock market of the UK.

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[8] Hardouvelis and Gikas A., "Evidence on Stock Market Speculative Bubbles: Japan, the United States, and Great Britain," Federal Reserve Bank of New York Quarterly Review (Summer 1988) : 4-16.

Later **Diba and Grossman (1984) and Hamilton and Whiteman (1985)** propose an empirical strategy based on stationarity tests for obtaining evidence against the existence of explosive rational bubbles without precluding the possible effect of unobservable variables on market fundamentals.

Diba and Grossman (1988) [9] report empirical tests for the existence of explosive rational bubbles in stock prices. The analysis focuses on a model that defined market fundamental to be the sum of an unobservable variable and the expected present value of dividends, discounted at a constant rate, and defined rational bubble to be self-confirming divergence of stock prices from market fundamentals in response to extraneous variables. The patterns of autocorrelation of the data as well as Dickey-Fuller tests both indicate that stock prices and dividends are nonstationary before differencing but are stationary in first differences. In contrast, first differences of simulated time-series of rational bubbles exhibit strong signs of non-stationary.

If the nonstationary of dividends accounts for the nonstationarity of stock prices, then stock prices and dividends are cointegrated. Although application of the cointegration tests suggested by **Granger and Engle** produced somewhat mixed results, these mixed results probably reflect low power of the tests rather than either the existence of rational bubbles or the presence of a nonstationary unobservable variable in market fundamentals. Most importantly, alternative tests suggested by **Bhargava** indicate that

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[9] Behzad T. Diba and Herschel I. Grossman, "Explosive Rational Bubbles in Stock Prices?," The American Economic Review 78, No. 3 (June 1988) : 520-530.

the relevant linear combination of stock prices and dividends is neither explosive nor has a unit root. In contrast, time-series of simulated rational bubbles failed the **Bhargava** tests. In sum, the analysis supports the conclusion that stock prices do not contain explosive rational bubbles.

Russell, Francis (1988) [10] are the researchers who study the stock market crash of October 1987. Until then, many journalists believed in the efficient of markets. In an efficient market, large numbers of equally informed actively participants' search for maximum profits, while prices reflect all available information and expected events. The crash weakened the faith in market efficiency, and commentators seized upon the notion of speculative bubbles as an explanation for its occurrence. In a bubbles, the price of an asset can be bid above its intrinsic value if the market believes others will pay more tomorrow. While the market booms for a time, participants eventually lose faith in further price rises, and the bubble bursts. Studies of recent market collapses do not offer much support of the bubble theory. The key stumbling block is the measurement of expectations. **Peter Garber**, professor of economists at Brown University, concludes that economists will probably never form a consensus that a bubble has affected prices in a specific market.

Some economists also try to account for the 1987 stock market crash as the bursting of a speculative bubble. **Anonymous (1989)** [11]arguing that investors were paying

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[10] Russell and Francis X, "The Bubble Bandwagon," InterMarket Journal (October 1988) : 51-52.

[11] Anonymous, "Crash Course," Economist Journal (October 1989) : 77.

more for assets than they were intrinsically worth in the belief that they could sell for more than they paid. This explanation admits that the market was overvalued before the crash, which is at odds with the efficient market theory. While the market was efficient in one sense-by not letting anyone make profits out of line with the risks accepted-it was inefficient because it inaccurately measured values. That inaccuracy is seen in the widening gap between steadily falling stock yields and sharply rising bond yields. In another example of inefficient on Black Monday, so-called value traders bought fewer stocks than might have been expected once prices had fallen precipitously. Thus, if examples of efficiency moved the market in the crashes of 1987 and 1989, efficiency is in no way related to stability.

Renshaw and Edward (1990) [12] note that there are 5 relatively simple rules for trying to identify bubbles of a cyclical nature in the areas of 1. Dividend yields, 2. High price-earning ratios, 3. Predicting bear market resulting from tight money, 4. No more than 2 good years in a row, and 5. Four hundred trading days. Moreover, they find that consensus forecasts are more accurate than most predictions and will sometimes have better track record than virtually all forecasting systems based on individual records or parsimonious models. If there were more value-conscious investors with a sense of history, the stock market might be a safer place in which to invest.

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[12] Renshaw and Edward, "Some evidence in Support of Stock Market Bubbles," Financial Analysts Journal (March/April 1990) : 71-73.

Dezhbakhsh, Hashem, Demirguc-Kunt, Asli (1990) [13] examined the existence of speculative bubbles in US stock prices by using a new test strategy. The strategy retains the specification tests applied by **West (1987)** to the first 2 equations but replaces West's indirect tests with 2 computationally simple tests with well-known small sample properties. The tests are likely to maintain their nominal size in small samples and to have desirable small sample power against a wide class of bubbles, including those orthogonal to the dividend process. The tests are applied to long-term annual US stock market data for the periods 1871-1981 and 1871-1988. The results provide evidence that the behavior of US stock prices does not corroborate the existence of speculative bubbles, as the tests do not reject the "no bubbles" hypothesis; the market boom of the 1980s does not appear to provide any support for the presence of bubbles.

Moreover, **Behzad T. Diba (1984) and Herschel I. Grossman (1988b) and Hamilton and Whiteman (1985)** have recommended the alternative strategy of testing for rational bubbles by investigating the stationarity properties of asset prices and observable fundamentals.[*]

According to **George W. Evan's paper (1991)**[14], it shows that the above test is in fact unable to detect an important class of rational bubbles. The point is

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[13] Dezhbakhsh, Hashem Demirguc-Kunt, Asli, "On the Presence of Speculative Bubbles in Stock Prices," Journal of Finance and Quantitative Analysis (March 1990) : 101-112.

[*] John Y. Campbell and Shiller (1987) have also discussed this strategy.

[14] George W. Evans, "Pitfalls in Testing for Explosive Bubbles in Asset Prices," The American Economic Review 81, No. 4 (September 1991) : 922-930.

demonstrated by constructing rational bubbles that appear to be stationary when unit-root test are applied even though they are explosive in the relevant sense. Simulations show that when such bubbles are present, stock prices will not appear to be more explosive than dividends on the basis of these tests even though the bubbles are substantial in magnitude and volatility. The presence of rational bubbles in actual stock prices thus remains an open question.

For the periodically collapsing bubbles, **Blanchard (1979) and Blanchard and Watson (1982)** describe bubbles that burst almost surely in finite time. However, **Diba and Grossman (1988c)** have shown that the impossibility of negative rational bubbles in stock prices implies theoretically that a bubble can never restart if it ever bursts. Nevertheless, **George W. Evan (1991)** concludes form his study that the periodically collapsing bubbles are not detectable by using standard tests to determine whether stock prices are "more explosive" or "less stationary" than dividends. His paper has not provided evidence that such bubbles are actually present in stock prices and it should be noted that there are important theoretical arguments that restrict the possibility of rational bubbles.

Froot and Obstfeld (1991) [15] suggest a different type of bubble phenomenon, which they term an intrinsic bubble. "Intrinsic" is used because the bubble depends (in a non-linear deterministic way) on fundamentals, namely the level of (real)

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[15] Kenneth A. Froot and Maurice Obstfeld, "Intrinsic Bubbles : The Case of Stock Prices," The American Economic Review 81, No. 5 (December 1991) : 1189-1214.

dividends. The bubble element remains constant if "fundamentals" remain constant but increases (decreases) along with the level of dividends. For this form of intrinsic bubble, if dividends are persistent then so is the bubble term and stock prices will exhibit persistent deviations from fundamental value.

In addition, the intrinsic bubble can cause stock prices to overreact to changes in dividends (fundamentals) which is consistent with empirical evidence.

Froot and Obstfeld test for the presence of intrinsic bubbles using a simple transformation of $P_t/D_t = c_0 + cD_t^{\lambda-1} + \eta_t$ where the null of no bubble implies $H_0 : c_0 = \alpha$ *and* $c=0$ *(where* $\alpha = e^r - e^{\mu+\sigma 2/2)}$*.* These tests tend to reject the no-bubble fundamental model. However, **Froot and Obstfeld** note that the OLS cointegrating parameter could be heavily biased **(Banerjee et al, 1993)** and that the power and size of these tests are problematic.

Froot and Obstfeld then consider a direct test for the presence of intrinsic bubbles and get a result of $(P/D)_t = 14.6 + 0.04D_t^{1.6(1.1)}$. The joint null, that c and λ-1 equal zero is strongly rejected; however, the empirical evidence is not decisive since we do not reject the null that $c=0$.

Finally, **Froot and Obstfeld** assess the sensitivity of their results to different dividend models (using Monte Carlo methods) and to the addition of various additional functions of D_t of other deterministic time trends in the regression. The estimates of the basic intrinsic bubble formulation are quite robust.

Next, **Driffill and Sola (1994)** repeat the Froot-Obstfeld model assuming dividend growth undergoes regime shifts, in particular that the (conditional) variance of dividend growth varies over the sample. They use the two-state Markov switching model of **Hamilton (1989)** to model dividend growth and this confirms the results given by ‘eyeballing’ the graph. However, their graph of the price with an intrinsic bubble is very similar to that of Froot and Obstfeld so this particular variant does not appear any to make a major difference.

Recently, **Grant McQueen and Steven Thorley (1994)** [16] find that the empirical attributes of bubbles such as autocorrelation, skewness and kurtosis are not unique to bubbles and are often associated with fundamentals. Therefore, they derive a new testable implication from the rational speculative bubble model, which is based on the statistical theory of duration dependence. Unlike attributes such as autocorrelation, skewness and kurtosis, the duration dependence is unique to bubbles. The new test also specifically addresses nonlinearity by allowing the parameter (probability of ending a run) to vary depending on the length of the run and on whether the run is of positive or negative abnormal returns.

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[16] Grant McQueen and Steven Thorley, “Bubbles, Stock Returns, and Duration Dependence,” Journal of Quantitative Analysis 29, No. 3 : 379-401.

They note that for bubbles to exhibit the characteristics of a long run-up in price followed by a crash, the bubble process must be skewed, with many small positive abnormal returns (no crash) and relatively few large negative abnormal returns (crash). For such bubbles to be rational the bubbles must be positive and explosive; that is the expected value of the bubbles must be increasing over time to compensate the investor for the possibility of a crash. The skewness and explosiveness of bubbles, combined with serially random innovations in fundamental value, result observed abnormal returns that exhibit duration dependence. If bubbles are present, then the probability that a run of positive abnormal returns ends declines with the length of the run.

Formally, runs of positive, but not negative, abnormal returns will exhibit positive duration dependence or a negative hazard function.

From the paper, test for duration dependence are performed on abnormal continuously compounded real monthly returns for both equally- and value-weighted portfolios of all New York Stock Exchange (NYSE) stocks from 1927 to 1991. Consistent with the existence of bubbles, evidence of a negative hazard function is found in runs of positive, but not negative, abnormal returns. Specially, as the length of the run of positive abnormal returns increases, the probability that the run will end decreases. This finding is statistically significant even though the abnormal returns are from regressions that include variables associated with the time-varying risk premiums and lagged returns. A number of alternative specifications of abnormal returns are examined that the rejection of no-bubble hypothesis is particularly robust in the equally-weighted portfolio.

Alternatively, **Kim, Chang-Jin, Kim, Myung-Jig (1996)** [17] use a fad model with Markov-switching heteroscedasticity in both the fundamental and fad components (UC-MS model), a study examines the possibility that the 1987 stock market crash was an example of a short-lived fad. While fads are usually thought of as speculative bubbles, what the UC-MS model seems to be picking up is unwarranted pessimism which the market exhibited with the OPEC oil shock and the 1987 crash. Furthermore, the conditional variance implied by the UC-MS model captures most of the dynamics in the GARCH specification of stock return volatility. Yet unlike the GARCH measure of volatility, the UC-MS measure of volatility is consistent with volatility reverting to its normal level very quickly after the crash.

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[17] Kim, Chang-Jin, Kim, Myung-Jig, "Transient fads and the crash of 1987," Journal of Applied Econometrics 11 (January/February 1996) : 41-58.